Outdoor Lighting
California Energy Efficiency Standards 2005

Illuminated Signs and Billboards

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Outdoor Illuminated Signs

- Externally Illuminated:
  - Billboards.
  - Roadside Monuments, Carved, Painted.
- Internally Illuminated:
  - Cabinet or Panel signs.
  - Channel Letters.
  - Unfiltered (neon, LED, other).

Design Criteria

- Current Good Practice:
  - Efficient sources.
  - Efficient optics.
- Brightness varies by lighting zones.
  - Brightness needs are relative to surroundings.
- Control requirements:
  - Turn off lights after business and traffic hours.
  - Avoid illumination during daytime.
  - Avoid excessive brightness at night.

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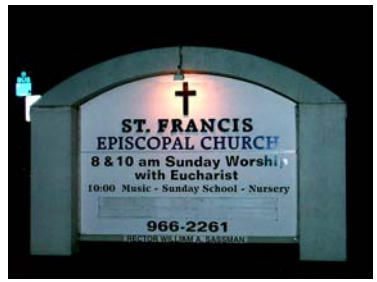
Billboards and Externally Illuminated Signs



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Billboard Luminaire Manufacturer Current Recommendations

height ft	width ft	area sf	# of lamps	W/lamp	W/sf	total watts
8	12	96	1	100	1.46	140
8	12	96	1	250	3.02	290
8	12	96	1	400	4.58	440
12	24	288	2	250	2.01	580
12	24	288	1	400	1.53	440
12	36	432	4	250	2.69	1160
12	36	432	3	400	3.06	1320
14	48	672	4	250	1.73	1160
14	48	672	4	400	2.62	1760
30	60	1800	14	250	2.26	4060
30	60	1800	14	400	3.42	6160

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Billboard Design Assumptions

- Light Source
  - Minimum 55 ml/w = standard metal halide.
  - Better performance available in future:
    - Pulse start, ceramic MH, electronic ballasts.
    - Longer life, better lumen maintenance.
- Luminaire position
  - Light from above.
    - Reduces dirt accumulation, improves light output 50% over life.
  - Use good optics, cut-off fixtures.
    - Avoid wasted light spilled beyond sign.
  - Use sign design for visibility
    - White borders to establish visual edge.
    - Don't bleed light to edge.

Billboard Requirements

- Light Source:
  - Minimum 55 ml/w = standard metal halide.
- Lighting Power

LZ1	LZ2	LZ3	LZ4
20W per face	1.0 w/ft^2	2.0 W/ ft^2	4.0 W/ ft^2
	100 W lamps	250 W lamps	400 W lamps

- Control requirements:
  - Turn lights off after business, traffic hours.
  - Turn lights off during daytime.

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Cabinet Signs

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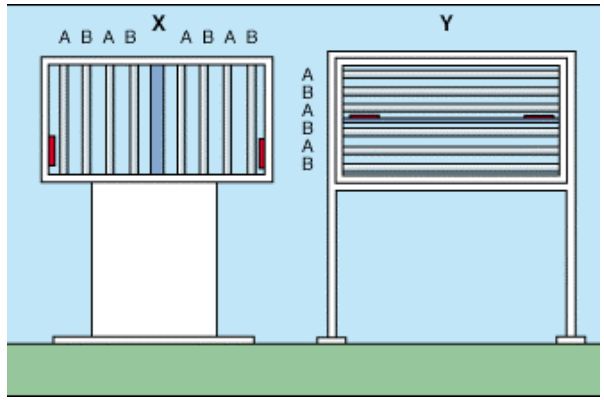
Cabinet Sign Issues

- Cabinet sign industry developed in 1950's.
  - Little development in lighting technology.
  - Biggest advance, from neon to fluorescent.
- Key client criteria:
  - Uniformity of illuminance, low maintenance.
  - UV resistance, physical strength.
- Results in:
  - Thicker plastics for greater diffusion.
  - Packing lamps close together to counteract low transmission plastic cover.
  - Extra lamps, so burn-out not noticed.

Cabinet Sign Construction



- Light Transmission:
  - White Acylic, 1/8” 15-32% (3/16” standard).
  - Colored - dependant on spectral characteristics of source 5-80%.
    - Fluorescent sources typically white, high losses w/ colored filter.
    - Neon colored source - lower losses w/ colored filter.
- Reflectance:
  - Tin or Aluminum - 50 - 70%.
  - White enamel - 70 - 85%.

Cabinet Sign Efficiency Options

- Common construction:
  - 6-9” depth of cabinet, lamps on 6-9” spacing for uniformity.
  - Pack box with maximum light output: T12s, high output.
    - To overcome low diffusion and transmission.
- Use better optical diffusion, prismatic lenses, reflectors.
  - Allows for wider spacing of lamps.
  - Brighter images with less power.
- Use more reflective surfaces.
  - 50% increase in light output due to reflectance, not power.
- Match source color to filter color when possible.
- Use better visual design.
  - Light image on dark background more legible.
  - Requires less light output, uniformity less critical.

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Cabinet Sign Design Criteria

LZ1. Minimal lighted signage in LZ1.

Identification purposes only.

LZ2. Low ambient lighting in LZ2.

Lower illumination levels needed to compete.

LZ3. Higher ambient lighting in LZ 3.

Current urban practice.

LZ4. Competitive lighting in LZ4.

Special effects, highest brightness.

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Cabinet Sign Requirements

- Light Source:
  - Minimum 70 ml/w = T8 w electronic ballasts.
- Lighting Power:

LZ1	LZ2	LZ3	LZ4
20W per face	4.0 w/ft^2	6.0 W/ ft^2	8.0 W/ ft^2
	24” o.c.	18” o.c.	12” o.c.

- Highly reflective interior materials - 80%+.
- Use translucent image, dark background.
- Controls:
  - Turn lights off after business, traffic hours.
  - Turn lights off during daytime.

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Channel Letters

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Channel Letter Issues

- Brightness of sign a function of:
  - Color of sign changes perception of brightness.
    - White - yellow - red - green – blue.
  - Color of source relative to color of filter.
    - Same color source and filter most efficient
  - Thickness of acrylic filter.
    - Larger signs need thicker acrylic = lower transmission.
- Efficiency of sign a function of:
  - Color of source. Neon has huge range (20-50 l/w).
  - Interior reflectances.
  - Transmittance of translucent cover.

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Channel Letter Requirements

- Light Source:
  - Minimum 25 ml/w = Neon.
- Lighting Power:
  - Too difficult to determine area, thus density.
- Highly reflective interior materials - 80%+.
- Use translucent image, opaque surrounds.
- Controls:
  - Turn lights off after business, traffic hours.
  - Turn lights off during daytime.

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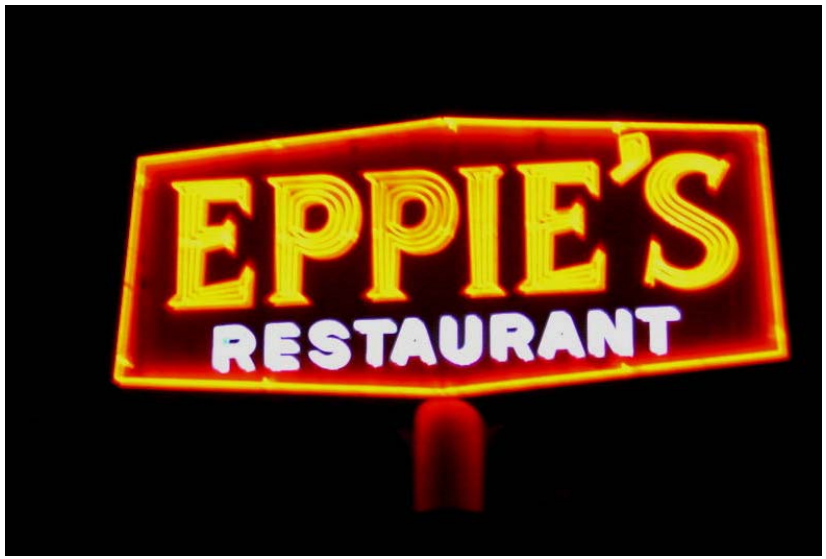
Unfiltered Signs - Neon and LED

The "Sun Blaster"



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Unfiltered Sign Issues

- Brightness of sign a function of:
  - Color of sign changes perception of brightness.
    - White - yellow - red - green – blue.
  - Directionality of source.
    - Neon diffuse, LED directional.
- Efficiency of sign a function of:
  - Color of source.
    - Neon has huge range (20-50 l/w) depending on phosphors.
    - LED rapidly evolving (10-15 current, 40-60 predicted).
  - Density of sources:
    - Neon - single or triple tubes?
    - LED - density of packing (1/4” o.c. ?) .

Signage Summary

- Externally Illuminated Signs:
  - LPD, controls.
- Cabinet Signs:
  - LPD, controls, internal reflectances.
- Channel Signs:
  - Minimum source efficacy, internal reflectances.
- Unfiltered Signs:
  - Minimum source efficacy, controls, 50% brightness.
- Sources less than 5 Watts excepted.
- LZ1 20 W per face.

Unfiltered Signs Requirements

- Light Source:
  - Minimum 25 ml/w = Neon, or less than 5W/source.
- Lighting Power:
  - Too difficult to determine area, thus density.
- Controls:
  - Turn lights off after business, traffic hours.
  - Turn lights off during daytime.
  - Ability to reduce to 50% light output, if operated both day and night.